Nanoscale Systems for Optical Quantum Technologies

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D4.5 Mini Summer School

Deliverable:	D4.5
Work package:	WP4 Management, dissemination and exploitation
Task:	4.2 Dissemination, communication and exploitation of knowledge
Lead beneficiary:	CNRS
Type:	Other
Dissemination level:	Public
Due date:	30 September 2017
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Author(s):	P. Goldner, D. Serrano (CNRS-CP)

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Version history

Version	Date	Author(s)	Description
V1	10/05/2017	P. Goldner (CNRS-CP)	First draft
V2	11/05/2017	P. Goldner/D. Serrano (CNRS-CP)	Final version for submission

Partners:
CNRS, Karlsruhe Institute of Technology, ICFO, Lund University, Aarhus University, Keysight Technologies.

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Deliverable Description

This deliverable corresponds to the mini summer school organized in the frame of the NanOQTech project. The school was held on May 2-4, 2017 at Chimie ParisTech (Paris, France), where the coordinator research group is located. We also took the opportunity of the school to have a general public conference and project meetings.

Overview of the meeting

The meeting gathered 30 researchers and students for 3 days, with all NanOQTech partners represented. The school included lectures by members of the consortium, as well as external speakers, and presentation by some of the PhD students and post-doc researchers involved in the project. Lab sessions were also organized to show the experimental activities at CNRS-CP. Dissemination towards the general public was emphasized with a public presentation given by Klaus Mølmer (AU) in front of more than 300 persons and entitled "l'ordinateur quantique" (the quantum computer).
Progresses in the project were reviewed too in sessions led by the WP leaders. Finally, the consortium PIs talked about management, dissemination and exploitation. The school ended with a visit to the Crystal Museum of Paris 6 University (http://www.collection-mineraux.upmc.fr).

The agenda and list of participants are given in Annex.

Lectures

Lectures took place on Tuesday and Wednesday mornings. They were limited to one hour, questions included, to keep a strong momentum and a focused attention from the audience. The lecturers were mostly young researchers, from the consortium or other institutions. Julia Benedikter, a PhD student at KIT, impressed the audience with a nice and informative talk on micro-cavities.

The authors and title/topic of the talks are indicated below.

Speaker	Institution	Title/main topic
Prof. L. Bausà	UAM-Spain	Rare-earth ion spectroscopy
J. Benedikter	KIT	Emitters in micro-cavities
Dr. D. Giaume	IRCP	Synthesis of nanoparticles
Dr. K.-J. Tielrooij	ICFO-NOE	Properties of graphene
Dr. S. Seidelin	CNRS-IN	Opto-mechanical resonators
Dr. T. Chanelière	LAC-France	Quantum memories

The talks gave the fundamentals of important topics covered by NanOQTech, including materials, spectroscopy, hybrid systems and functionalities, in connection with quantum technologies. In some cases, like the talk on graphene, part of the presentation was

devoted to the schemes that are investigated in the project. The aim was to expand young researchers background to help them with their work in NanOQTech but also their future researches. The lectures were very well received, with many questions asked to each speaker, and fulfilled their objectives.

Prof. Luisa Bausà (Autonomous University of Madrid) presenting a lecture on rare earth spectroscopy.

Presentations have been collected by the coordinating group and will be made available to participants through shared folders and downloads. Some presentations will also be uploaded to the open access platform Zenodo.org.

PhD Students and Post-Doctoral Researchers Presentations

To promote interactions between young researchers and improve their communication skills, NanOQTech PhD students and post-doctoral researchers were asked to present their work in 20 minutes. Six talks were given on different topics (see Table below).

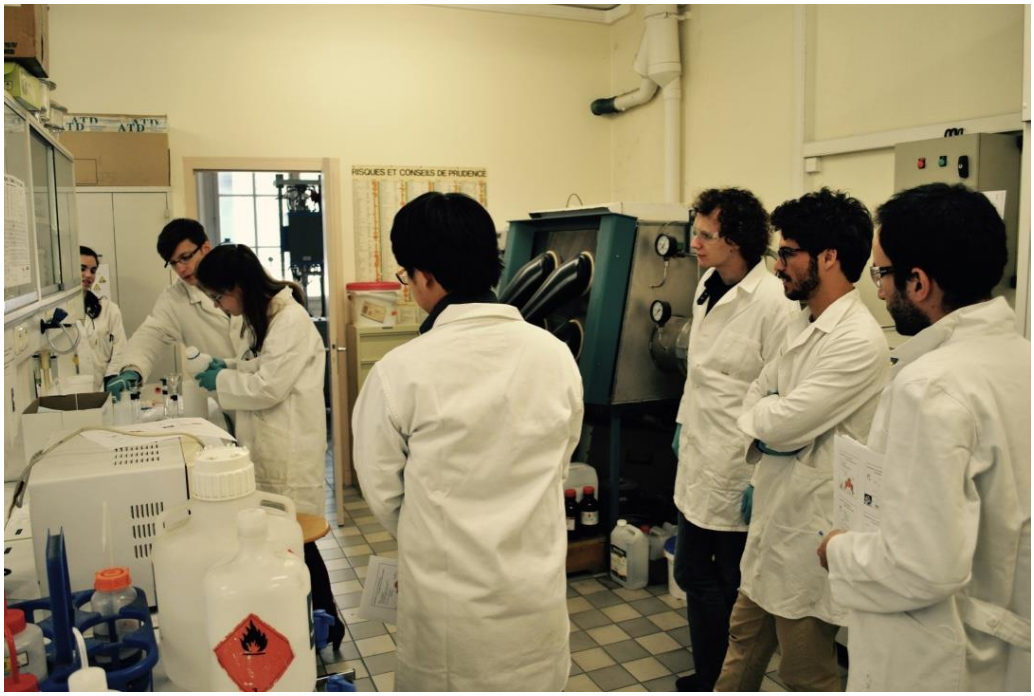
Speaker	Institution	Title/main topic
Dr. D. Cano	ICFO-NOE	Quantum operations with emitters coupled to cavities
A. Fossati	CNRS-CP	Investigating coherence properties in Eu doped nanoparticles
Dr. Y. Zhang	AU	Quantum emitters meet plasmon-polariton
N. Galland	CNRS-IN,SY	Using SDR platform to probe rare-earth doped crystals
M. Scarafagio	CNRS-CP	Er doped Y_2O_3 thin films by ALD deposition
Dr. B. Casabone	KIT	Towards cavity-enhanced single RE ion detection

The presentations were well prepared and of high scientific quality. They raised strong interests in the audience. Young researchers were indeed able to introduce their work to each other, which should encourage stronger collaborations within the project, and discuss their results with senior researchers from a broad range of fields. It also gave an overview of the status of the different activities pertaining to NanOQTech, in preparation to the discussions on the scientific WPs.

A. Fossati (CNRS-CP) presenting his PhD work on europium doped nanoparticles.

Lab Course

We organized two lab courses for the participants, who were divided in two groups. They were related to the core activities at CNRS-CP in NanOQTech: material synthesis and spectroscopy. Concerning materials, the different steps of nanoparticle synthesis by homogeneous precipitation were shown and explained, followed by structural characterization by X-Ray diffraction. Thin film elaboration by spin-coating was also shown.
In the second course, the principles of optical spectroscopy of nanoparticles in the form of powders were demonstrated and discussed. Topics highlighted were light collection in cryostats and heterodyne detection of photon echoes in a highly scattering medium.
The attendants found the lab course very useful to get a better idea of how the materials they are using were produced and what were the issues faced in the process. The spectroscopy part was especially useful for groups like ICFO or ULUND, which are going to use this technique, which was developed at CNRS-CP.



Lab course on nanoparticle synthesis at CNRS-CP.

General Public Talk

We took the opportunity of the summer school to ask Klaus Mølmer (AU) to present a general public talk at Chimie ParisTech, the host institution of the coordinator. K. Mølmer has been giving such talks in many occasions in Denmark, where there is a strong incentive for scientists to communicate towards citizens, and was therefore and ideal speaker in this respect. The talk was given in French to ensure maximum impact, a challenge that Klaus Mølmer met with ease. The lecture hall was full, with more than 300 people attending, mostly external to the institute. Many questions about the promises, feasibility, goals and even ethics of quantum computing were asked after the presentation. The general feedback was extremely positive. NanOQTech and the EU were mentioned in the introduction to and during the talk, and in the announcements. We plan to further develop the impact of this conference, e.g through French-Danish programs for dissemination.

Work packages

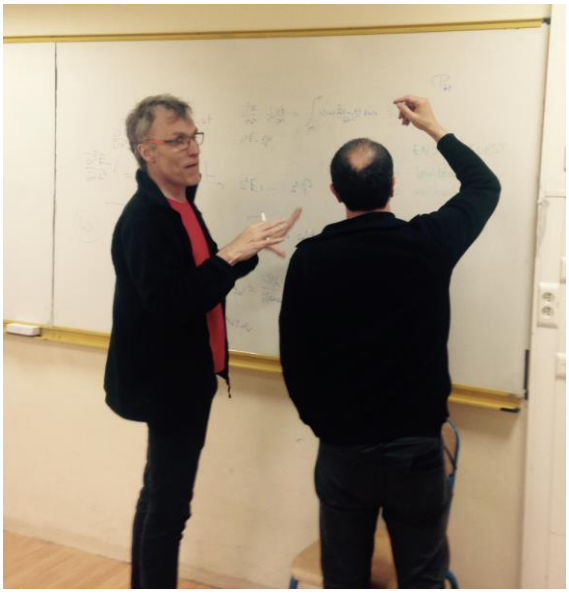
The discussions on WPs were lead by the WP leaders, Ph. Goldner (WP1), D. Hunger (WP2), S. Seidelin (WP3) and P. Goldner/D. Serrano (WP4). Slides were shown with WP and tasks descriptions, together with deliverables and milestones. We focused on the results already obtained and the next 12 months of the planned activities. These slides have been collected for distribution to the partners.

Important points that have been discussed for WP1,2,3 are:

- status of recruitment on the project
- progress towards objectives of the partners
- presentation and discussion of deliverable D2.1 by S. Kröll (ULUND)
- next deliverables and milestones to be achieved
- collaborations between partners.

These discussions were very useful to clarify e.g. sample needs, experimental issues, results.

The discussion on WP4 first dealt with the next deliverables to be achieved, like the Dissemination and Exploitation Plan and the report on quantum technologies. We then focused on the form that the scientific and management deliverables should follow to fulfil the EU requirements, and how they will be evaluated. The Data Management Plan was explained and the obligations to submit papers and data to the open archive Zenodo.org were highlighted. We also discussed the timeline for the first review meeting, including report contents and deadlines for contributions.



K. Mølmer (AU) and Y. Le Coq (CNRS-SY) at the white board during a coffee break.

Conclusion

The summer school fulfilled its goals towards young researcher training and skill development, according to the general feedback from the participants and lecturers. The various topics covered and lab courses raised high interests, and we enjoyed a nice working atmosphere during these three days. The general public lecture on quantum computing was very successful, at the highest level of attendance for such seminars at Chimie ParisTech. EU funding importance, as well as NanQOTech objectives were strongly emphasized during the event.
The project review was very fruitful too to ensure strong collaboration within the consortium, clear paths towards NanOQTech objectives and efficient management.

Annex: Agenda and List of Participants

NANOQTECH SUMMER SCHOOL 2 - 4 MAY 2017

DAY 1

8:45 *Welcome breakfast* – *RDC bas / Salle 3*

9:15 – 12 :30 Lectures – *RDC bas / Salle 8*

- **9:15** - Luisa Bausá (UAM)
- **10:15** - Julia Benedikter (KIT)

Coffee break

- **11:30** Lecture: Domitille Giaume (ENSCP)

Lunch buffet

14:00 – 17:00 Lab practical work (LPW) – *IRCP-MPOE labs – RDC haut (escalier B)*

- LPW 1: Nanoparticles and thin films synthesis
- LPW 2: Optical characterizations on nanoparticles

17:30 Business meeting – *Salle du Conseil*

19:30 Business diner – *Bistrot Mauzac* (address → 7, rue de l'Abbé et de l'Epée, 75005 Paris)

DAY 2

8:45 *Welcome breakfast* – *RDC bas / Salle 3*

9:15 – 12:30 Lectures – *RDC bas / Salle 8*

- **9:15** - Klaas-Jan Tielrooij (ICFO)
- **10:15** - Signe Seidelin (CNRS-IN)

→ 11:15 Group picture

Coffee break

- **11:30** - Thierry Chanelière (CNRS-LAC)

Lunch buffet

NanOQTech

14:00 – 16:00 NanOQTech's PhD students and postdocs talks – *RDC bas / Salle 8*

- **14:00** - Daniel Cano (ICFO)
- **14:20** - Alexandre Fossati (CNRS-CP)
- **14:40** - Yuxiang Zhang (AU)
- **15:00** - Nicolas Galland (CNRS-IN)
- **15:20** - Marion Scaragagio (CNRS-CP)
- **15:40** - Bernardo Casabone (ICFO)

18:30 *"L'ordinateur quantique"* by Klaus Moelmer – *Amphitéâtre Friedel*

20:00 Cocktail Diner – *ENSCP Library*

DAY 3

8:45 *Welcome breakfast* – *RDC bas / Salle 3*

9:15 – 12:30 Work packages discussion – *RDC bas / Salle 8*

- **9:15** - WP1: Nano-materials, optical micro-cavities and control systems.
- **10:15** - WP2: Spin-atom-photon interfaces.

Coffee break

- **11:15** - WP3: Opto-electrical and opto-mechanical hybrid systems

Lunch buffet

14:00 Visit to Jussieu's crystallographic collection

NanOQTech

Participants:

Institut de Recherche de Chimie Paris - IRCP- CNRS-CP

Marion Scarafagio
Alexandre Fossati
Shuping Liu
Zhonghan Zhang
Sacha Welinski
Alban Ferrier
Diana Serrano
Philippe Goldner
Bruno Viana
Alexandre Tallaire
Domitille Giaume

Lund University

Stefan Kröll

Karlsruhe Institute of Technology - KIT

Julia Benedikter
David Hunger

ICFO - Quantum Photonics with Solids and Atoms

Hugues de Riedmatten
Chetan Deshmukh
Bernardo Casabone

Keysight Technologies

Nestor Oliverio

Institut Néel

Signe Seidelin
Nicolas Galland

SYRTE

Yann Le Coq

ICFO – Nano-Optoelectronics

Klaas-Jan Tielrooij
Daniel Cano

Aarhus University

Klaus Mølmer
Yuxiang Zhang
Yuan Zhang

Autonomous University of Madrid

Luisa Bausà

Laboratoire Aimé Cotton (Orsay, France)

Thierry Chanelière
Lucile Veissier
Benjamin Car